



INTERNAL AUDIT CONTROLS EVALUATION STREET LIGHTING

June 20, 2005

Roanoke City Council Audit Committee
Roanoke, Virginia

We have completed our audit of Street Lighting. Our audit was performed in accordance with generally accepted government auditing standards.

BACKGROUND

All street lighting in the City is administered through the Traffic Engineering section of the Transportation division. There are approximately 9,600 street lights that are owned and maintained by American Electric Power and leased to the City. There are a small number of lights, such as those on decorative poles in the downtown area that are owned and maintained by the City.

American Electric Power bills the City on a monthly basis with a flat fee charged for each light. Monthly charges for each light vary from \$5.23 - \$26.00, dependent on several factors such as the type of light, wattage, type of pole and whether the power lines are above ground or below. The rates are consistent with those charged to other localities, as they were established by the Virginia Municipal League's Appalachian Power Steering Committee. In fiscal year 2004, the City spent approximately \$1,000,000 on street lighting.

All street lights in the City contain high pressure sodium bulbs. High pressure sodium bulbs are recommended for use in street lighting by the Virginia Department of Transportation as well as the Illuminating Engineering Society of North America. High pressure sodium bulbs are more energy efficient than most other varieties of light and have a longer life with good retention of light output. In the 1990's, American Electric Power migrated from a less efficient mercury vapor bulb system to what is now a system exclusively composed of high pressure sodium bulbs.

The City has a one-page policy pertaining to new street lighting. This policy is included in an application packet that is provided to all citizens who request a new street light. Citizens requesting a new light must fill out an application justifying the need for a new light and must include signatures of surrounding neighbors of the proposed light. Four times a year, requests are evaluated and either approved or denied based on the criteria stated in the street lighting policy. The bulb wattage is set by the Transportation division based on the type of street on which the light will be located. Residential streets are illuminated by 9,500 lumen lights; collector streets, such as Grandin Road, are illuminated by 22,000 lumen lights; arterial streets, such as Williamson Road, are illuminated by 50,000 lumen lights.

Vision 2001-2020, the City's comprehensive plan, specifies that lighting should be decorative and pedestrian-scaled in downtown, commercial centers and village centers.

Vision 2001-2020 discourages excessive lighting in commercial and industrial corridors in order to preserve the view shed. Street lighting is not specifically addressed by the comprehensive plan.

SCOPE

Our audit focused on procedures in place as of January 1, 2005, and all American Electric Power owned and maintained street lights within the boundaries of the City of Roanoke. We did not evaluate the management and maintenance of City-owned street lights.

OBJECTIVES

The objectives for this audit were to determine if the design and operation of the system of internal controls is adequate to ensure:

- Street light billings are reasonable based on the number and type of properly operating lamps.
- Only authorized and appropriate lights are included in American Electric Power's inventory of City street lights.
- The concentration of lights and plans for future street lighting comply with Vision 2001-2020 guidelines.

METHODOLOGY

We gained an understanding of processes pertaining to street lights by reviewing existing policies and procedures, forms, and files. We interviewed managers and staff in the Transportation division and documented their routine processes. We reviewed invoices and maps from American Electric Power to develop our understanding of the billing process. We obtained street lighting policies from several other localities in order to determine common practices. We also reviewed Virginia Department of Transportation manuals as well as industry guides in order to identify recognized standards against which we could evaluate our street lighting program. We documented our understanding of the system of controls in place with process outlines and narratives. Based on this understanding, we developed a test program to evaluate the operation and effectiveness of significant controls.

Our test plan included reviewing street light applications and associated forms to determine if requests were properly evaluated and approved requests were in accordance with established policy. We physically visited locations to verify existing street lights were the appropriate wattage for the type of street being illuminated and

were positioned to primarily light the street rather than personal property. We also polled localities in the Virginia First Cities Coalition to compare the number of street lights in Roanoke to other localities. Using street lighting maps and the latest available inventory of street lights (1998) from American Electric Power, we evaluated the overall street light system against recognized criteria for street lighting.

RESULTS

We were unable to identify generally recognized benchmarks for light concentrations or other aspects of lighting. We considered street lights per capita and street lights per square mile of land area as two measures of light concentration that might be informative. We gathered data from those cities in the First Cities Coalition as a basis for comparison, with the following results:

City	Population	Square Miles	# of Lights	Lights per cap.	Lights per mi.
Hampton	145,200	57.40	11,400	0.08	198.61
Lynchburg	65,269	50.11	10,200	0.16	203.56
Roanoke	94,600	43.00	9,566	0.10	222.47
Newport News	180,900	69.00	19,075	0.11	276.45
Portsmouth	97,600	29.90	11,585	0.12	387.46
Norfolk	241,000	66.00	30,225	0.13	457.95
Richmond	195,300	62.55	37,000	0.19	591.53

On the basis of lights per square mile, the City of Roanoke compares favorably with other Virginia cities from the perspective of potential over-lighting and corresponding higher expenditures. The monthly rates paid by the City for its street lights are based on the tariff agreement negotiated by the Virginia Municipal League and are consistent with other Virginia localities served by American Electric Power.

Finding 01 – New Light Installations

The Transportation division has a documented policy for installing new street lights. That policy sets out the goals of the program and some basic criteria for evaluating the need for a new street light. The essence of the street lighting program as stated in the policy is to adequately light the City's streets with any secondary benefits as to lighting yards, porches, driveways, etcetera, being coincidental. The policy also requires that applicants circulate a petition among "surrounding" residents and ask for their signatures in support of the installation.

We randomly selected 20 approved applications for new street lights and found that 11 of the 20 had justifications that were primarily based on secondary benefits, such as lighting the neighborhood. We also noted that 4 of the 20 approved applications did not include a self-certifying petition. The remaining applications we reviewed included requests for 28 street lights and required a petition for each light. We noted that 15 of

the 28 petitions did not include residents whose properties were directly impacted by the proposed light.

Under the current policy, the primary criterion considered when evaluating requests is the distance between existing lights. If the distance between existing lights exceeds 300 feet, the light is approved. The policy goes on to state that the required distance between lights may be reduced based on the curvature of the road or other unusual circumstances such as churches, parks, schools, accidents, etcetera. There are no formal internal guidelines for evaluating light requests based on criteria other than distance between lights. Information gathered during the site visits and in the office, related to spacing between lights, accident rates, characteristics of the street, and other factors used in evaluating requests, are not documented.

Each new street light costs the City a minimum of \$63 a year up to \$312 per year. Each new light contributes from 9,500 to 50,000 lumens of light to the surrounding environment. More stringent evaluations of light requests would support the Vision 2001-2020 goal of discouraging excessive lighting while also constraining incremental increases in street light expenditures over time.

Action Plan 01 – New Light Installations

The Transportation division will develop a more detailed process for evaluating street light requests. Formal criteria will be established as a basis for evaluating the need for street lighting to provide a safe street. These criteria could include accident data, street characteristics, secondary light sources, and crime data. Staff members will document the findings of their evaluation and retain the documentation with the request form and other related paper work. Additionally, the staff will verify that self-certifying petitions include all residents with adjoining property and all residents directly across the street from a proposed light.

The Transportation division began verifying self-certifying petitions on May 1, 2005. The new criteria and new process for evaluating street light requests should be fully developed and in place by December 31, 2005.

Finding 02 – Street Light Invoices

Based on our research related to street light billing, we cannot verify the accuracy of monthly invoices for street lights. The invoices from American Electric Power list each type of light leased to the City, the number of units leased, the rate per unit, and the total charge. It is our understanding that when American Electric Power's billing system was installed, they input only the summary data [i.e., the number of units and rates] and have added and deleted units to the invoice as requested by the City. The City's Transportation division does not maintain an inventory of leased street lights.

American Electric Power maintains a mapping system that has street lights graphically

plotted on a grid map. This system cannot produce a listing of street lights located in the City summarized by type. American Electric Power was able to provide maps showing the lights in specific grids as requested by our department. We utilized these maps to evaluate the concentration of lighting and the lumens used for various types of streets. Since the maps are in no way used to generate monthly invoices, we could not use them to verify the bills.

Monthly invoices for street lighting are approximately \$70,000 and are reviewed by the City on this historical basis. If an invoice were to be significantly higher than \$70,000, the Transportation division would contact American Electric Power for an explanation. The accuracy of the historical data reflected in the invoice cannot be certified without significant effort on the City's part to compile its own inventory.

Action Plan 02 – Street Light Invoices

Based on responses we received from localities across the United States, we found that several localities maintain an inventory of street lights on their geographical information systems or their real estate systems. In the City of Roanoke, the Department of Technology is currently implementing an asset management system in the Parks and Recreation department. The asset management system is planned as an enterprise system that will eventually be implemented in the Transportation division, Facilities Management division, and possibly the Fleet Management division. This system will track all significant City assets and the work performed on those assets. The system will be phased into departments as funding becomes available. In order to implement the asset management system in Transportation, an inventory of the City's infrastructure will need to be compiled. There are companies that compile images and GPS locations of public infrastructure to establish the base line inventory of assets. Any request for proposal that is developed for such a service should include a requirement addressing the need for street light data. Once the data is available, street lighting invoices should be validated by the Transportation division on a monthly basis.

There were other, less substantial issues that we noted over the course of the audit. We shared these issues with management in our closing conference and in a separate management letter.

CONCLUSION

Based on the results of our audit work, we conclude that the design and operation of the system of internal controls could be strengthened to provide greater assurance that street light billings are reasonable based on the number and type of properly operating lamps; that only authorized and appropriate lights are included in American Electric Power's inventory of City street lights and that the concentration of lights and plans for future street lighting support Vision 2001-2020 goals. Given the available data, we were unable to conclude on the accuracy of street light billings.

We would like to thank the management and staff of the Transportation division for their cooperation and assistance during this audit.

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